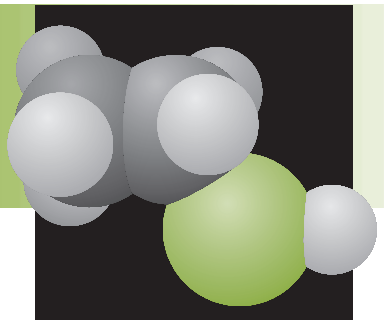
CHEMICALS
Project Fact Sheet



Clean Fractionation—Inexpensive Cellulose for Plastics Production

Benefits

- Saves 53.9 trillion Btu per year of energy by 2025
- Reduces waste by 2.2 million tons per year by 2025
- Ensures environmental compliance
- Requires only modest capital investment
- Saves $1.2 billion in production costs by 2025
- Expands the use of renewable feedstock

Applications

Refined cellulose is required for the manufacture of rayon and acetate fibers used in apparel, curtains, and draperies, and in thermoplastics used in tool handles, toys, automotive parts, surface coatings, films, food thickeners, latex paints, drilling muds, and cellophane.

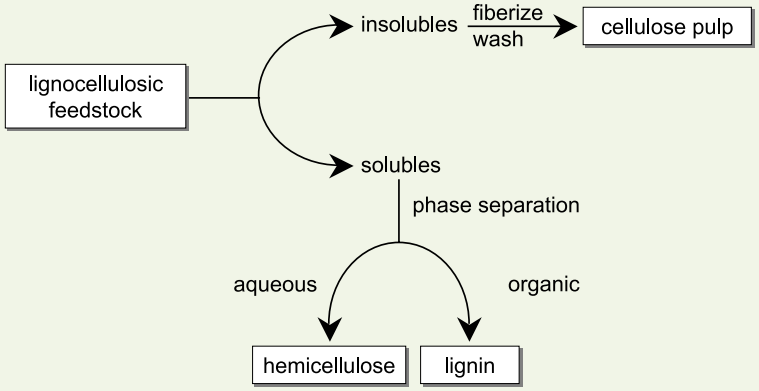
The Clean Fractionation technology is directly applicable to other cellulose-consuming processes, including the $1 billion cellulose ethers market.

Pure cellulose feedstock is produced with environmentally sound, low-cost process

Cellulose is a high-volume renewable feedstock that is “refined” from wood and used to manufacture paper and chemicals. Manufacturers can tolerate impurities in the cellulose used for paper products but require nearly 2.5 billion pounds each year of a highly purified form of cellulose to produce ethers and esters that are used to manufacture rayon, acetate fibers, and thermoplastics. If purified cellulose could be produced at a lower cost than via the existing wood-pulping processes, the use of renewable feedstock in chemical production would expand.

Clean Fractionation is a promising new process that could provide a superior cellulose feedstock, along with energy savings, lessened environmental impacts, and reduced production costs. Clean Fractionation uses indigenous renewable feedstock and is economically viable for smaller on-site operations, thereby reducing industry’s capital investments. Features of the technology that ensure its low impact on the environment (high yield, minimal waste, low emissions, and environmentally benign cellulose purification) could foster wide-spread industry adoption.

Clean Fractionation



The Clean Fractionation Process separates cellulose components which can then be purified with an environmentally benign process.

Project Description

Goal: To cost-effectively prepare a highly purified form of cellulose that can be used as a chemical feedstock for the production of cellulose esters.

In Clean Fractionation, wood components are selectively separated by treating the wood with organic solvents and water to dissolve the lignin and hemicellulose. The lignin is found in the organic phase and can be isolated by solvent evaporation. Hemicellulose is obtained as a dilute aqueous solution. The cellulose is easily purified using TCF (totally chlorine free) or ECF (elemental chlorine free) bleaching processes.

Specific tasks include making modifications in reaction conditions, with a goal of removing as much of the residual material from the cellulose as possible. However, the cellulose must retain a high-enough quality to ensure it has the performance parameters required for further processing. Another task is to make modifications in cellulose purification to ensure the quality of the cellulose. Hemicellulose must be removed without degrading the cellulose, and a standard bleaching procedure must be determined. NREL will test at least three alternative bleaching processes. Analytical measurements will be carried out to better define the "fitness for use" of the cellulose.

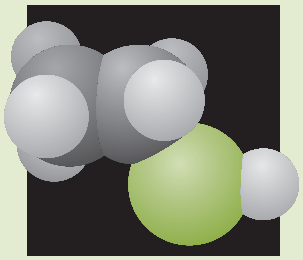
Scale-up of the process will provide large amounts of pure cellulose for testing in actual fiber-spinning processes, and for determining the physical properties of the fibers. The process for separating, bleaching, and purifying the cellulose will be optimized.

Progress and Milestones

- Wood separation has been reproducible on several scales, and the environmentally benign purification technology has been tested.
- The next step is to complete a laboratory scale investigation (0.5 to 2.0 kilograms of product per run) of the process, and then begin scale-up work.
- Commercialization of the technique will be carried out by the chemical industry.

Patents

NREL was awarded a patent for the Clean Fractionation process for biomass.



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